UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

REPORT

ON

STUDIES OF INSECT LOSSES ON CUTOVER AREAS

OF

DISTRICT 5.

By
H.L. Person
Junior Entomologist

U.S. Bureau of Entomology

Box 3010,
Stanford University
February 20, 1926

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A REPORT ON STUDIES OF INSECT LOSSES

ON CUTOVER AREAS OF DISTRICT 5.

The studies made on six cutover areas on the Sierra National Forest in 1924 showed that the average loss from insects, on these areas, amounted to 50 percent of the increment. (See "Studies on the Relation of Insect Loss to Management Policy; June 9, 1924, by Person and Stanford). Mr. T.D. Woodbury suggested that these studies be continued and that mule areas on other National Forests in California be included so that the findings would be generally applicable in District 5. This suggestion was carried out during the summer of 1925 by a co-operative study between the Bureau of Entomology and the Forest Service.

The purpose of this study was to determine the extent of insect damage to western yellow pine on cutover areas, and the conditions under which this loss is most serious. The possibility of reducing the loss probably through an improvement in marking methods was also to be considered. No effort was made to find average conditions but rather the prevalence of bad conditions. Most of the worst yellowpine areas in California, from the standpoint of insect losses, have probably been included.

Yellow pine and yellow pine-sugar pine stands, only have been considered as the insect loss in other forest types in California is negligible. Although we have some data on losses in sugar pine it is far from complete and only yellow pine will be considered in this report. (For available data on sugar pine see the above mentioned report on the Sierra cutover studies.)

Practically all of the insect loss found on the areas examined was caused by the western pine beetle (Dendroctonus brevicomis) LeC. ssp. and buprestids are only of secondary importance.

CONDUCT OF THE SURVEY

Cooperation:

Mr. Woodbury and Mr. J.M.Miller aided in selecting areas suitable for study.

The surveys were made by the writer assisted by A. Wagner, Scientific Aid.

Salaries were paid by the Bureau of Entomology and the general expenses by the Forest Service.

Travel was by automobile on government mileage.

Costs:

	Bureau of Entomology	Forest Service	Total
Salaries 112 man-days	$472.00		
Subsistence 112 man-days @ $1.20		$134.40	
Mileage 2,120 miles at .07		$148.40	
	$472.00	$282.80	$754.00

Areas Examined

In all, 25 cutover areas located in 6 National Forests of California were examined. The distribution of these areas by Forests is as follows:

National Forest	No. of Cutover Areas Examined.
Sierra	8
Stanislaus	5
Shasta	5
Plumas	3
Lassen	2
Sequoia	2

Of these areas, a number were unsuitable for study because of insufficient data, or other reasons, and records on only 12 will be included in this study. See Table 1 for a summary of the data on these areas. This table includes three of the Sierra areas which were included in the 1924 report. These areas were re-examined in 1925 and given here to make this report more nearly complete.

As in the 1924 study each area is reported separately according to the same form so that they may be easily compared. These data are attached to the end of this report as an appendix.

METHODS

Determination of Insect Losses.

The insect losses were determined by 100% strip cruises in all areas except the Shasta #2 area on which only a 20% cruise was made by Person and Wagner supplemented by a 20% cruise by the Forest Service.

All of the insect killed trees were blazed and numbered, located on a map, and the diameter and height, and the year when killed, recorded on tree record.

Determination of Increment.

Where a sufficient number of increment cores was taken the increment was determined independently for each area. The per cent of increase in basal area was used as an index to the increase in volume. For the other areas Dunning's figures for plots of a similar site and condition were used. Increment wherever mentioned in this report means only the increment of trees over 12" DBH.

Insect Losses.

It was found that while most of the cutover areas are comparatively free from insect injury the losses on some of the areas are strikingly high. On the areas studied this loss varied from 15% of the increment to as much as 21 times the increment. On one of the Shasta areas 15% of the total stand, that was left after logging, was killed in one year. This is an extreme case but it was evident that on a number of the poorest sites on the Shasta Forest, the insects are undoubtedly killing off the reserve stand. As there is practically no reproduction on these areas they will probably be reduced to brush flats. This high loss was found not only on the cutover areas but in the uncut stands as well. Small shotgun areas of uncut timber surrounded by cutover areas seemed to be especially susceptible to insect loss. However, losses on site IV and V, the more evident, are not nearly as important as losses on the better sites. On the poor sites even without insect loss there is no appreciable increment. The worst that can happen is the loss of the reserve stand which is usually small on such areas. But the good sites are depended upon for our timber production now and in the future. On four of the areas studied, two site II and two site III, the insects are taking the equivalent of over 50% of the increment of trees over 12 inches in diameter. This loss is serious because it means that the productiveness of the area is lowered to that of a site IV or V on which timber production is unprofitable.

The losses on the different areas studied are given in Table I. Plate I illustrates graphically the relation of this loss to the increment on the areas studied. These areas are not intended as representative of average conditions, but rather of those areas having the heaviest insect losses. Such areas are common enough to seriously affect any plan of forest management in which the factor of insect loss is not considered.

Conditions Affecting Losses.

The evidence given in Tables I, II, and III indicates that:

1. The loss on areas logged within the last few years is apparently no greater than the loss on areas logged 15 or more years ago (Table I).

One exception to this should be noted. In any case where a logging operation which has been in progress for some time suddenly stops, there is apt to be a flare-up in the infestation in the immediate vicinity. This flare-up may increase the loss on the cutover area the first year. This is only a temporary condition caused by the stopping of the supply of fresh slash thus forcing the insects emerging from the old slash to attack living trees.

Such a condition was noted on the Lassen Lumber and Box Company Sale near Duck Lake in 1923 and on the Peach and Fig Growers Sale on the Stanislaus in 1925; as well as on a number of other areas, both by the writer and other forest workers.

2. The heaviest losses are found on the poorest sites.

On site V the loss is heaviest when figured either as the absolute loss per acre or as per cent of stand or increment.

The actual loss per acre may be as high on a Site II as on a III or IV but the loss in per cent of stand or increment is not as heavy as on the poorer sites. The reason for this is that the stand and the increment is always smaller on the poor sites while the loss per acre is often about the same.

3. The insect loss on cutover areas varies in general with the infestation in the surrounding timber.

This point is difficult to prove, principally because it is often impossible to find suitable check areas in uncut stands on which the loss can be compared with the loss on the cutover areas. It is believed that the many irregularities in Table III are due to this fact rather than to any lack of relation. Taking the averages for each forest a very close relationship between the loss on the cutover areas is shown. This evidence is supported by numerous observations on many of the Southern Oregon areas as well as on a number of California areas not included in this report.

The importance of this conclusion lies in the fact that it can be used in determining the probability of insect loss on any sale area before it is logged.

The insect loss on most of the Lassen and Plumas areas is so low that it can be disregarded.

At the other extreme practically all of the yellow pine areas on the Shasta are susceptible to insect damage and should be treated accordingly.

The other forests studied vary so much in different districts that no general statement can be made.

4. The western pine beetle kills the slowest growing trees in any area.

This conclusion is based not on the data secured in connection with this study, alone, but on measurements of the growth rate of over 2,000 D.B. killed trees and living check trees. These measurements showed that on the average the insect-killed trees were growing over 40% slower than the green check trees.

The application of this fact to this study is shown graphically on Plate II. On this plate the distribution by growth rate curves for the insect-killed trees and living check trees of the same diameter and location are compared. These curves are based on over 500 cores taken from cutover areas on the Shasta and the Sierra National Forests. The growth rate is low as only the poorer sites were included but the relationship would be the same or even more striking on the better sites. Studies

made in Southern Oregon indicate that the per cent of difference in the growth rate of D.B. killed trees and the living trees increases with the quality of the site.

Suggestions for Reducing the Loss.

The use of artificial control methods for reducing the loss is not practical under the conditions found on most of these areas. Experimental control projects have shown that it is practically impossible to reduce an endemic infestation on small areas which are not isolated from other infested stands. Most of the cutover areas do not have this isolation. Therefore, the solution to this problem will probably depend on modifications in our present forest management plans or improvements in their application.

Our suggestions are based on two points brought out in the preceding discussion, namely: (1) the insect loss on cutover areas varies with the infestation in the surrounding timber and (2) the western pine beetle kills the slowest growing trees. The first point gives us a key to the determination of probable losses on any area and the second gives us a key to the reduction of losses on the bad areas.

On all areas.

It seems evident that if all trees growing below a certain minimum (which should be determined for every site class) were taken out in logging the insect loss would be materially reduced. Since these slow growing trees produce very little wood and are at the same time the biggest risk, there is no question about the advisability of taking out such trees. The difficulty is in locating these trees. Mr. Dunning is working on this phase of the problem and has considerable promise of success. Where the insect loss is apt to be serious it would probably pay to test each doubtful tree with an increment borer.

The curves on Plate II illustrate the possibilities of reducing losses by taking out slow growing trees. If all the trees with a ring width of less than .6 millimeter were taken out the loss would (theoretically) be reduced 64% while the stand would be reduced only 30%. Actually the reduction in insect loss might not be that great. But on the other hand it should be possible by improving marking methods to take out most of the slow growing trees with very little if any reduction in the stand.

On Site III and Poorer.

Dunning's studies show that even without considering insect loss it seldom pays to leave a reserve for increment on site III or poorer because of the slow growth rate. On any such area where there is added the risk of loss from insects it seems evident that trees should be left only for seeding or site protection never for increment or as a reserve for a second cut.

The wisdom of leaving even seed trees, on certain areas, may be questioned where the insect risk is high and the chances of successful reseeding are poor.

On Site II.

The risk involved in leaving a considerable number of merchantable trees for increment as a reserve for a second cut is hardly justifiable even on the better sites where the insect loss may amount to from 30% to over 100% of the increment.

SUMMARY

1. Insect losses on Forest Service cutover areas, while low on most areas, are strikingly high on a number of areas.
Annual losses amounting to from one seventh of the increment to 21 times the increment were found.

2. In general, the heaviest losses are found on the poorest sites but heavy losses are also found on sites II and III.

3. The insect loss on cutover areas varies in general with the infestation in the surrounding timber.

4. On site III and poorer, where the gain from increment is low, no trees should be left for increment. Where an area is especially susceptible to insect losses it might be advisable to cut all merchantable trees except where necessary to protect the site.

5. On site II or better, where insect losses are a probability, fewer trees should be left for increment.

6. The western pine beetle selects the slow growing trees. If present timber marking methods are improved so that all of the trees with a growth rate below a certain minimum were taken out, the insect loss would be reduced. This minimum growth rate would have to be determined for each site.

RECOMMENDATIONS FOR FURTHER STUDIES.

1. One of the principle points to work out is the amount of reduction in insect loss that will result from the taking out of all the slow growing trees. In any area, the western pine beetle selects the slowest growing trees. Even on the best sites the D.B. killed trees are decidedly slow growing. The extent to which the elimination of all of these slow slow growing trees will reduce insect loss should be determined.
To carry on such a study it would be necessary to locate a large body of yellow pine timber susceptible to D.B. losses fairly uniform as to site and amount of insect infestation, which was to be cut within a few years.

Part of this area, preferably a full section, would be marked and logged so that no trees growing less than a set minimum rate would be left on the area. The remainder of the area would be marked and logged in the normal manner. A comparison of the insect loss on the two differently marked areas for a long period would show the effect of taking out the slow growing trees.

2. It would also be advisable to work out infestation zones according to probability of insect damage for all Forest Service Areas where timber sales are planned. These zones would have to be based on the amount of infestation in the general area until more definite methods of determination can be developed.

3. A number of the areas that have been studied should be reexamined every three years to determine the insect loss over a considerable period.

TABLE I.

Summary of Data

Forest	Area	Type	Site Class	Size in Acres.	Logged	Annual Increment Per Acre %	Annual Increment Per Acre Bd. Ft.	Annual Insect loss per acre. Bd. Ft.	Insect Loss in per cent of increment.
Shasta 1	Morrison	Y.P.	V	640	1905	.6	6.6	25	400
" 2	" 34	Y.P.	IV	320	1919, '20	.7	7	16	229
" 3	Van [illegible]ell	Y.P.	V	80	1925	.7	7.7	164	2340
" 4	[illegible]	Y.P.	IV	160	1918	.8	4.8	9	200
Sierra 1	Prescott	Y.P.	IV	1240	1918.'23	.36	6	32.5	540
" 2	Shaver	Y.P-S.P.	II	600	1907-11	.73	38.4	47.5	124
" 3	Blue Canon	Y.P.	II	360	1907-10	.83	36	25	70
Stanislaus	Cold Spring	Y.P.-S.P.	II	100	1912	1.20	185	58	30
" 2	Center Camp	Y.P.-S.P.	II	200	1916-17	.9	36	12.5	35
Plumas 1	Portola	Y.P.	III	320	1910	.95	88	46	55
Lassen 1	Bunnel	Y.P.	III	640	1924	.8	40	6	15
Sequoia 1	Hume	Y.P.	III	80	1923	.9	36	27	75
	Averages			400		.6	41	40	

TABLE II

Relation of Site to Insect Loss

Area		Site	Insect Loss: Bd. Ft. per Acre: By areas	Site average	Percent of Total Stand: By areas	Site Average	Percent of Increment: By areas	Site average
Sierra	2		47.5		.9		124	
Stanislaus	1	II	58	38	.4	.55	30	65
" "	2		12.5		.3		35	
Sierra	3		25		.6		70	
Plumas	1		48		.5		55	
Lassen	1	III	6	27	.1	.43	15	48
Sequoia	1		27		.7		75	
Shasta	4		9		1.5		200	
Sierra	1	IV	32.5	19	1.8	1.60	540	323
Shasta	2		16		1.6		230	
" "	1		26		2.4		400	
" "	3	V	164	99	15.0	8.70	2140	847

TABLE III

Relation of Insect Losses on Cutover Areas to the Surrounding Infestation.

	Insect Loss in Trees Per Section.			
	Cutover Areas		Uncut check Areas	
Shasta N.F.	By areas	Av. for Forest	By Areas	Av. for Forest
Morrison 28	120		100	
Morrison 34	65	183	150	145
Van Dremerwell	520		100	
Bray	28		230	
Sierra N.F.				
Prescott	30		20	
Shaver	8	16	12	27
Blue Canon	10		50	
Sequoia N.F.				
Hume	24	24	50	50
Stanislaus N.F.				
Cold Spring	18	14	30	22
Center Camp	10		15	
Plumas N.F.				
Portola	28	28	15	15
Lassen N.F.				
Bunnel	13	13	10	10

PLATE I

Insect Loss Compared with Increment, By Areas

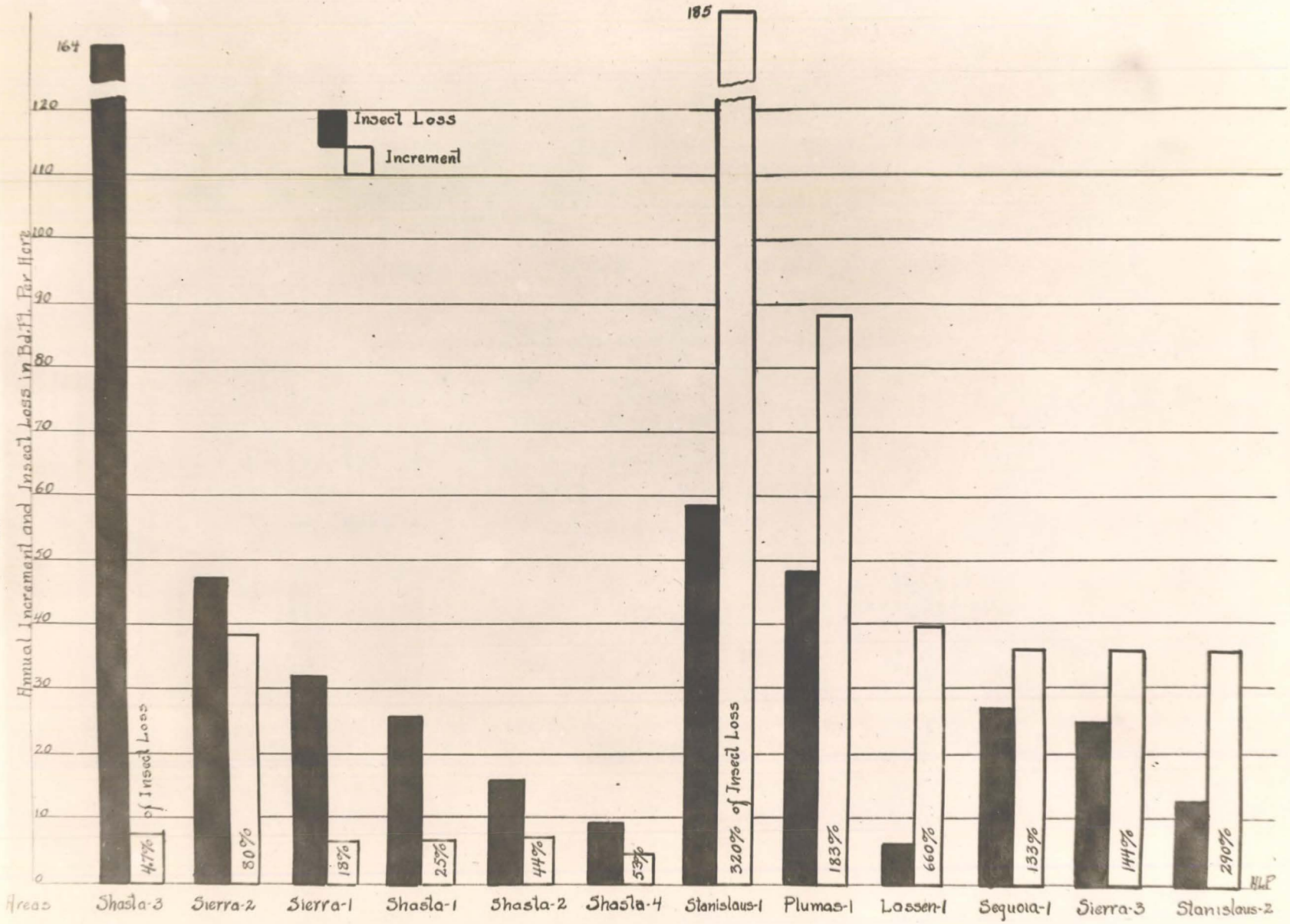
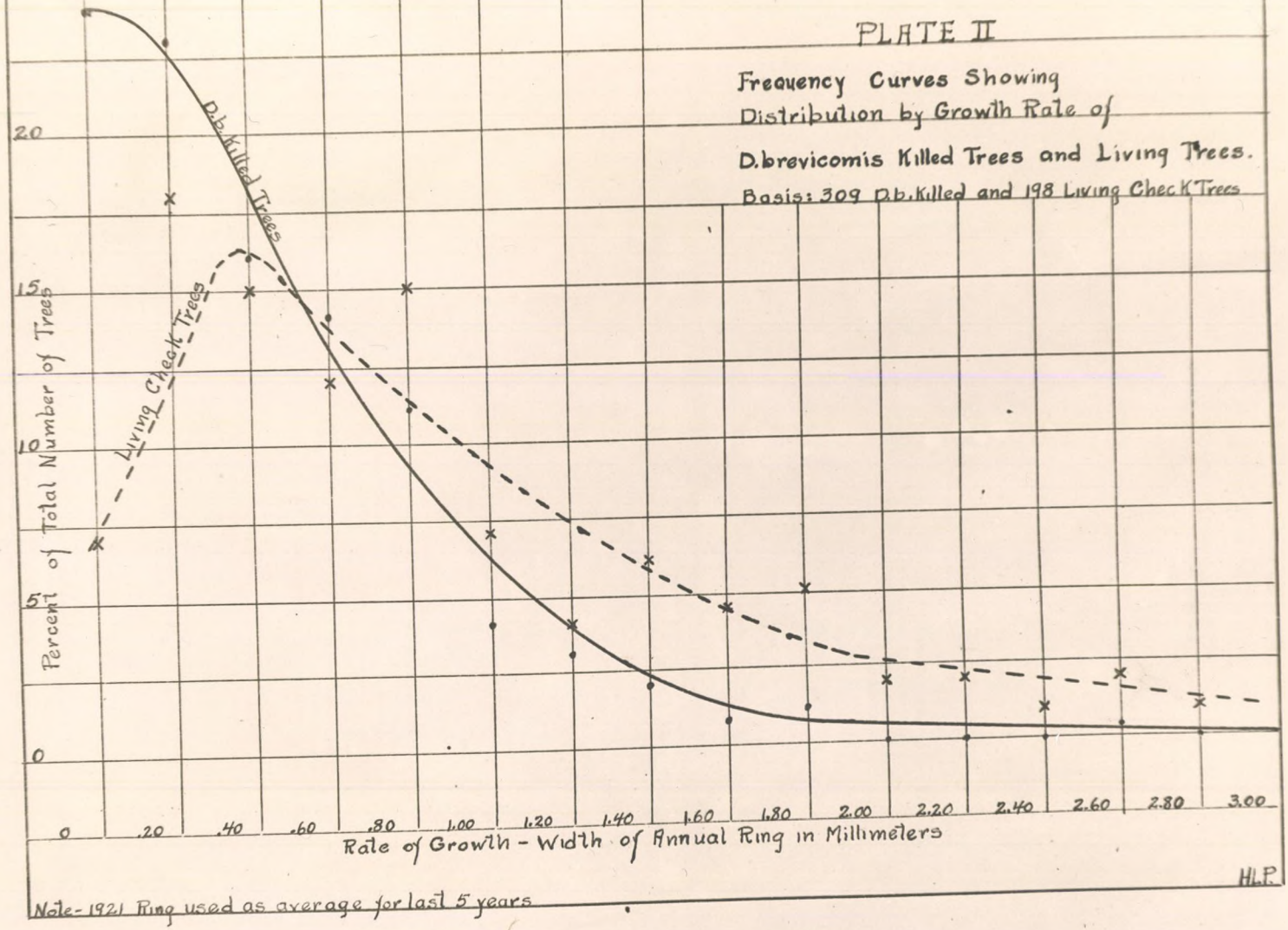


PLATE II

Frequency Curves Showing
Distribution by Growth Rate of
D. brevicomis Killed Trees and Living Trees.
Basis: 309 D.b. Killed and 198 Living Check Trees



H.L.P.

Note - 1921 Ring used as average for last 5 years

APPENDIX

Shasta 1.

1. Morrison Area #1.

2. Sec. 28 T 43 N R 3 W Mt. Diablo Meridian Shasta National Forest.

3. Examined August 25, 26, 1925.

4. Logged 1905 by Weed Lumber Company. A trespass area. 6,500 M.B.M. of yellowpine was taken from the area.

5. The area includes a full 640 acres.

The elevation is 5,800 feet.

The type is pure yellow pine, site V.

The soil is a volcanic ash with outcropping lava ridges.

The topography is level.

The area is bounded by a clean cut area on the south, a thin, scattered yellow pine stand on the North, a fair yellow pine stand on the east and a brush flat on the west.

6. This section was logged with wheels and horses.
As this was a trespass cuting, the Weed Company did their own marking, taking all of the best trees over 12" .
No slash disposal practised.

7. When cruised in May, 1925, by the Forest Service, there was a stand of 710,400 bd. ft. on the section or an average of 1,100 bd. ft. per acre.
There is practically no reproduction.

The ground cover is 90% brush.

8. Annual increment.

Basis, number of increment cores	243
Number of rings in last inch	36
Average annual increase in diameter	.03
Average diameter of trees, over 12"	10'
Average annual increment in percent	.6
" " " " " bd. ft. per acre	6.6

9. Insect loss - Cutover Area.

A. Bureau of Entomology 100% Cruise.

Yellow Pine	1924 Summer		1924 Winter		1925 Summer		1½ yrs. loss	
	Tr.	Vol. bd.ft.	Tr.	Vol. bd.ft.	Tr.	Vol.bd.ft.	Tr.	Vol.bd.ft.
	55	8790	63	9,160	59	7,230	177	25,150

1 year's loss per acre = 26 bd. ft.

B. Forest Service - 100% cruise

All standing, dead trees included. Probably represents about 7 year's loss.

Trees -	Vol. bd. ft.	Loss per A. 7 year's	1 year
441	113,910	176 bd.ft.	25 bd. ft.

Uncut Check Area.

¼ section in 10 ch. strip along road between Morrison and Bray.

1 year's loss per section - 68 trees 23,800 bd. ft.

High average loss would be over 100 trees per section for this locality.

10. Relation of Insect loss to Increment. (Trees over 12" only).

Annual increment per acre	6.6 bd. ft.
Annual insect loss per acre	26 bd. ft.

This shows a net annual loss of nearly 20 bd.ft. per acre. At this rate all the volume represented in trees over 12" in diameter would be lost within 50 years.

1. Harrison Area #2

2. Sec. 34 - W. 2/3 of Sec. 2 45 N - R 3 W. Shasta M.F.

3. Examined Aug. 27, 1925.
Forest Service cruise, April 27, 29, 1925.

4. Logged 1919 and 1920 by Weed Lumber Company.
Cut of Yellow Pine 5,728,980 bd. ft.

5. The area includes 990 acres at an elevation of 6,000 ft.
The type is yellow pine with some white fir and incense cedar in mixture.
The site is about a IV or V.
The soil is volcanic ash with lava cut cropping.
The typography is rolling to moderately steep with a west exposure.
The area is bounded on the south and west by cleam cut areas and on the north and east by uncut yellow pine stands.

6. The area was logged with power skidders working from railroad track thru the center of the area.
Late selection system of marking used.
Slash was piled and burned.
Condition of the area only fair with noticeable logging damage.

7. The area has a stand of 990 bd. ft. per acre of yellow pine with a small amount of fir and cedar.
The reproduction is poor.
The ground cover is mostly brush.

8. Annual increment for yellow pine.

Basis number of cores	25
Number of rings in last inch	25
Ave. annual increase in diameter	.06
" diameter of trees	16
" annual increment in percent	.7
" " " " " bd. ft. per A	.7

9. Insect loss, yellow pine -
A. Cutover
Bureau Entomology cruise 20%
16 bd. ft. per acre
Forest Service cruise 20%
14.7 bd. ft. per acre.

B. Uncut check area.
The uncut area on the east had an insect loss for 1924 and the first half of 1925 equivalent to about 150 trees per section per year.
This estimate was based on a 100% cruise of a strip 10 chains wide and 1 mile long just east of the cut over area.

10. Relation of insect loss to Annual Increment -

Annual increment per acre - 7 bd. ft.
Annual insect loss per acre - 16 " "
The insect loss on this area is more than twice the increment leaving a net loss of 9 bd. ft. per acre annually.

Shasta 3.

1. Van Bremer Well Area.

2. Sec. 18 S.W. of N.W. and the N.W. of S.W. forties - T 44 N R 2 E. Shasta National Forest.
3. Examined Sept. 1, 1925.

4. Logged 1924 by the Weed Lumber Company.
Cut of 541 M.B.M.

5. The area includes 58 timbered acres in two forties.
The elevation is about 5,000 ft.
The type is pure yellow pine, site V.
The soil is a volcanic ash.
The topography is rolling with south exposure.
The area is bounded on the east, south, and west, by cutover lands or brush flats and on the north by an uncut stand of yellowpine with a heavy insect infestation.

6. The area was logged with power skidders and railroads. Little logging damage was noted.
The late selection system of marking was used.
The slash was piled and burned.

7. The area when cruised in March, 1925, had a stand of 63,000 bd. ft. of yellow pine, or 1,100 bd. ft. per acre.
The reproduction is poor.
The ground cover is largely needles and bitter brush.

8. Annual increment yellow pine. -

Basis, number of increment cores	59
Number of rings in last inch	26
Average annual increase in diameter	.08
Average diameter of trees (over 12")	20
Average annual increment in per cent	.7
" " " in bd. ft. per A	7.7

9. Insect loss - 100%

	Trees	Vol. in bd. Ft.
1 year - Total	65	9,560
Per acre 1.1		164

No check area was cruised but the adjoining timber on the north was estimated as having an insect loss equivalent to 100 trees per section. This loss is the heaviest observed in the Antelope Valley areas.

10. Relation of insect loss to Annual Increment -

Annual increment per acre - 7.7 bd. ft.
Annual insect loss per acre 164 bd. ft.

Note: According to a 100 % cruise made March 12, 1925, by Goldsmith and Billigg of the Shasta N.F. the insect loss amounted to 148 trees and containing 28,200 bd. ft. for this area. The reason for this discrepancy between the Bureau of Entomology cruise and the Forest Service cruise is not known.

Shasta 4.

1. Bray Area.

2. Sec. 32 - S W of S E¼, S½ of S.W. ¼ and part of N.W. of S.W.¼ T 44 N, R 1 W. Shasta N.F.

3. Examined Aug. 29, 1925.

4. Logged 1918 - Cut of 1,125,000 bd. ft.

5. The area includes 160 acres in the pure yellow pine type, Site IV.

The elevation is around 5,000 ft., the soil a volcanic ash. The area is level with open brush flats on the N and W, a clean cut area on the south and an uncut stand of yellow pine on the east.

6. The area was logged with wheels and trucks.

The group selection system of marking was used.

7. The area when cruised in the spring of 1925 had yellow pine -

96,000 bd. ft., or 600 bd. ft. per acre.

The reproduction is fair to poor, the ground cover brush, needles and duff.

8. Annual increment.

The number of increment cores taken on the area was not sufficient to serve as a basis for estimating the increment. However, the increment for a site III area of this type would be around .6% for trees over 12 inches, giving an annual increment per acre of 4.8 bd. ft.

9. Insect loss - 100% Cruise.

A. Cutover area	1924 Summer and winter		1925 summer		Total 1½ yrs. Tr. Vol.
	Tr.	Vol.	Tr.	Vol.	
Yellowpine	7	1,770	5	450	19 2,220

Loss for one year would be 1,480 bd. ft. or 9.2 bd. ft. per acre.

B. Uncut check area - 160 acres, north and east.

	1924 Summer and winter		1925 Summer		Total Tr. Vol.
	Tr.	Vol.	Tr.	Vol.	
Yellowpine	35	32,370 bd. ft.	51	41,126 bd.ft.	86 73,690

= loss for 1½ years

Trees Volume.

Loss for 1 year would be 58 - 49,126 bd. ft.
or the equivalent of 232 trees per section.

10. Relation of Insect loss to Annual Increment.

Annual increment per acre	4.8 bd. ft.
Annual insect loss " "	9.2 " "

It is noticeable on many of the poorer areas of the Shasta N.F. that not only are the cutover areas suffering badly from insect loss but many of the uncut areas as well - especially small shot-gun areas nearly or entirely surrounded by cut over area.

Other Shasta National Forest Areas.

Besides the four areas studied, a summary of the Forest Management records of 19 other areas was submitted by L.F. Kellogg, Junior Forester of the Shasta. Of these 19 areas all ten of those that had an appreciable insect loss were site V or V- areas, while all of the site III and IV areas had very little loss. The annual loss per acre on these areas could not be figured as most of the areas had been cut a number of years and the loss given as the total evident loss since cutting, not as annual loss.

1. Gold Spring Area.

2. Sec. 31, parts of the N.W. and the S.W.¼ T. 4 N R 18 E. Stanislaus M.D.

3. Examined August 2, 1924, and June 28, 1925.

4. Logged in 1912 by the Standard Lumber Company.

5. The area studied includes only 160 acres of cutover land in the yellow pine-sugar pine type lying in the triangle formed by the Tuolumne River and the north and west section lines of Sec. 31.

The elevation is between 5,000 and 5,500 feet.
The area is classed as Site II.
The topography is moderately steep with principal exposure to the S.E.

6. The area was logged with power skidders.
Group selection method of marking was used.
The slash was piled and burned.

7. The stand composition left after cutting is as follows:

Yellow pine 64%. The yellow pine stand is approximately 15,000 bd.ft. per acre.
Sugar pine 26
White fir 5
Incense cedar 5

The loss in the sugar pine is negligible as only the yellow pine is considered.
The reproduction is poor.
The ground cover is mostly brush and needles and duff.

8. Annual increment for yellow pine (trees over 12" only)

Taken from a Forest Service sample plot on the area by Dunning
Annual increment in per cent 1.20
" " " bd. ft. per acre. 185

9. Insect loss, yellow pine - 100% Cruise.

Annual loss for three year's 1922 and 1924 inclusive

1922		1923		1924		Total		Average.	
Tr.	Vol. bd. ft.	Tr.	Vol.	Tr.	Vol.	Tr.	Vol.	Tr.	Vol.
2	8090	5	8260	2	1140	9	17490	3	5830

Annual loss per acre 58 bd. ft.

10. Relation of Insect loss to Annual Increment

Annual increment per acre 185 bd. ft.

Annual insect loss per acre 58

On this area the insect loss amounts to about 30% of the total increm

1. Center Camp Area.

2. S½ of the N.W. ¼ and N.½ of the S.W. ¼ of Sec. 28 and 40 acres in the E½ of Sec. 29 T 3 N R 16 E Stanislaus N.F.

3. Examined July 31, 1924.

4. Logged 1916-17 by the Standard Lumber Co. Cut of 4,573,000 bd. ft. of yellow pine sugar pine type with a small per centage of white fir and incense cedar.

The elevation is between 3,800 and 4,500 feet.
The site is about 80% II and 20% III.
The topography is moderately steep with N.W., N.E., and S.W. exposures.

5. The area includes 200 acres in the yellow pine-sugar pine type with a small per cent of white fir and incense cedar.

The elevation is between 3800 and 45 00 feet.
The site is about 80% II and 20% III.
The topography is moderately steep with North, West, Northwest, and Southwest exposures.

6. The area was logged with low speed, ground lead skidders and the area was left in fairly good condition.
The selection system of marking was used.
The slash was piled and burned.

7. The present stand of yellow pine is about 4,000 bd. ft. per acre.
The reproduction is poor.
The ground cover is mostly bear clover with some brush patches and opening with a cover of needles and duff.

8. Annual increment for yellow pine.

Basis, number of acres	40
Number of rings in last inch	28
Average annual increase in diameter	.036
Average diameter of trees over 12"	28
Average annual increment in per cent	.9
" " " " bd. ft. per acre.	36

9. Insect loss, yellow pine - 100% cruise

Cutover area

Average for three years 1921 to 1924
2,510 bd. ft. or 12.5 bd. ft. per acre.

Uncut check area

A 200 acre uncut check area on the west was cruised and found to have a loss of 72.5 bd. ft. per acre for the same period.

The loss in trees per section averages between 15 and 20.

10. Relation of Insect Loss to Annual Increment

Annual increment per acre 36 bd. ft.
Annual insect loss per acre 12.5 bd. ft.
This is probably an average insect loss for an area of this type and site on the Stanislaus N. F.

Plumas 1.

1. Portola Area.

2. Sec. 27 S½ T 25 N R 13 E Plumas National Forest.

3. Examined Sept. 10, 1925.

4. Logged 1910 by Feather River Lumber Company.

5. The area includes 320 acres at an elevation between 5,000 feet and 5,500 ft.
It is a yellow pine type Site III with some sugar pine, Douglas fir, White fir and incense cedar in mixture. The per centage of each in the original stand is as follows:

Y.P.	73.7%
S.P.	3.8
D.F.	9.2
W.F.	4.2
I.C.	9.1

The soil is a compact clay loam with scanty rock out croppings along the ridge.
The topography is level to a 30% gradient with a S.E. aspect.

6. Logging was carefully done with donkeys and chutes, leaving the area in good condition.

The group selection method of cutting was used, favoring yellow pine and sugar pine and marking heavily the White fir, Douglas fir, and incense cedar.
57% by volume and 27% by trees of the original stand was cut with the expectation of a second cut in 30 years.

The slash was lopped, piled and burned.

7. The remaining stand per acre is as follows:

Y.P.	9.100
S.P.	400
D.F.	610
W.F.	160
I.C.	900

Total 11,170 bd. ft.

The reproduction is scanty.
The ground cover is largely needles and duff with a small amount of brush and 20% squaw carpet.

8. Annual increment.

The increment for this area is based on the increment as determined by Dunning for sample plots on the area, as follows - (yellow pine only considered):

Per cent .95 bd. ft. per acre 88

9. Insect loss 100% cruise.

1 year's loss - 1924 winter brood and 1925 summer brood.

14 trees 15,440 bd. ft. or 48 bd. ft. per acre.

10. Relation of Insect loss to Annual Increment.

Annual increment per acre	88 bd. ft.
Annual insect loss per acre	48 bd. ft.

On this area the Insect Loss is 55% of the increment. This is the heaviest insect loss found on any of the cutover areas of the Plumas N.F.

Lassen 1.

1. Annual Area.

2. Sec. 35 T 30 N R. 10 E Lassen N.F.

3. Examined Sept. 5, 1925.

4. Logged June to September 1924 by Lassen Box & Lumber Company.

5. The area includes 640 acres of yellow pine type with some sugar pine, white fir and cedar in mixture especially on the upper slopes of Goat Mt.
The Elevation is between 4800 and 5700 feet.
The site is largely III with a small per cent of IV.
The topography is moderate to fairly steep with principal exposures to the south, east and west.
The area is entirely surrounded by uncut stands of timber with a moderate infestation.

6. The area was logged with horses, caterpillars and trucks. A few thousand feet of logs were still on the area when examined, but they contained very little infestation.
The late selection plan of marking was used.
The slash was piled and burned.

7. A stand of about 5,000 bd. ft. per acre was left on the area.

The reproduction is good except on the upper rocky slopes.
The ground cover is largely needles and duff with a small amount of brush.

8. Annual Increment for yellow pine.

The annual increment for this area was not figured but on the basis of studies of similar areas by Dunning the increment on this site should be about .8 per cent for the trees averaging around 20"
Figuring a stand of 5,000 bd. ft. of yellow pine to the acre the annual increment would be 40 bd. ft. per A.

9. Insect loss. Yellow pine - 100%

1 year's loss 15 trees 3770 bd. ft. per section or 6 bd. ft. per acre

The insect loss in the uncut stands adjoining was estimated to be 40 trees per section for 1924.

10. Relation of insect loss to increment.

Annual increment per acre	40 bd. ft.
Annual insect loss per acre.	6 bd. ft.

On this area the insect loss is 15% of the increment.

This area was reported by Wickman of the Lassen N.F. as the area having the heaviest insect loss of any of the Forest Service cutover areas on the Lassen N.F. As a whole the Lassen National Forest is remarkably free from insect infestation and most of the cutover areas have only a negligible loss from insects.
This insect loss in the uncut stands is also very low except on some of the dry ridges in the northern part of the Forest on sites IV and V.
Strip cruises 10 chains in width and for a total of 24 miles along roads show an average loss of only ten trees per section annually from insects for the last two years. The loss on some of the poorer dry sitesin the northern part of the forest will amount to between 50 and 100 trees to the section over small areas.

Sequoia 1.

1. Burne Area.

2. Sec. 11, 2-40s N.E. of Clark's cabin T 1 33 R 28 E Sequoia N.F.

3. Examined Oct. 14, 1925.

4. Logged 1923.

5. The area includes 80 acres in a pure yellow pine type site III.

The elevation is about 5,500 feet.

The topography is rolling to moderately steep.

6. The area was logged with wheels which did very little damage.

The late selection system of marking was used.

The slash was piled and burned.

7. The area has at present a stand of about 4000 bd. ft. of yellow pine.

The reproduction is fair.

The ground cover is largely needles and duff with a small amount of brush

8. Annual increment, yellow pine.

The annual increment for a site III area of this kind would be about .9 and the annual increment in bd. ft. per acre is estimated to be 36 bd. ft.

9. Insect loss, Yellow pine - 100% cruise.

	Tr. Vol.
1924 Total	3 2130 bd. ft.
Annual loss per acre 27 bd. ft.	

10. Relation of Insect loss to Annual Increment.

Annual increment per acre (trees over 12" only)	36 bd. ft.
Annual insect loss per acre.	37 " "